manner. The wall *act,* indicated by dotted lines, may be removed, as it is useless.

The construction shown by Fig. 51 is very good; in this there are two vertical regenerators placed side by side in place of a horizontal regenerator. The correct direction is given to the flowing gas currents. The main defect of these regenerators is due to the frictional resistance which they offer to the passage of the gases.

Regenerators in which the built-up checkerwork is replaced by vertical channels or cells, constructed in a manner similar to
that used in the hot-blast stove designed by Withwell, are considered in the section upon " Hot-blast Stoves."

III. HOT-BLAST STOVES

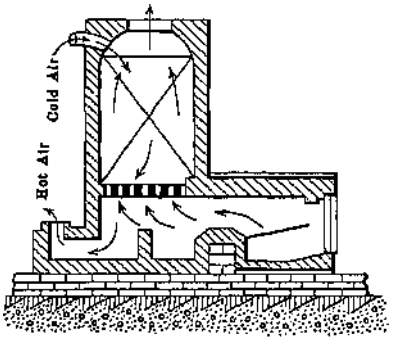

FIG. 59.

The regenerative principles of Siemens were applied by Cowper in 1860 to the heating of the air for blowing blast furnaces, *w* At first, however, these hot-blast stoves were not a success. Percy Wedding, in his *Manual of Metallurgy,* shows some of the early designs of hot-blast stoves, one of which is given in Fig. 59. The first stoves were heated with coal fires; the gas from the blast furnace was not utilized until later. The hot products of combustion from the fire flowed directly upward to the top of the stove and passed out of the structure through a primitive chimney valve
in the dome. The cold blast

entered the apparatus at the top and

[1] *Note by translator.*—The early blast furnaces were simple open-topped shafts with no bell or hopper. The gas was burned at the head of the furnace, and the blast pressure was very low. The charging was very elementary; in many cases the top of the furnace was reached by an inclined plane up which the charge was carted in simple dump-carts which were backed up to the open shaft and dumped the charge into it. Later, when the bell and hopper were utilized to close the top of the furnace the gas became available for heating the blast and making steam. (The name, Hot Blast Stove, is a survival from
the early coal-fired stove.)